



WASATCH FRONT  
**WATER QUALITY**  
COUNCIL

WFWQC Utah Lake  
Tour  
September 13, 2017



# POTW's

## What Are We?

Giles Demke  
OCWRF

# Question - What is Water Pollution?

Water pollution is the contamination of water bodies (e.g. lakes, rivers, oceans, aquifers and groundwater). This form of environmental degradation occurs when pollutants are directly or indirectly discharged into water bodies without adequate treatment to remove harmful compounds.

- Sources of Water Pollution:
  - Point Source - any single identifiable source of discharge
  - Nonpoint Source - many diffused sources caused by rainfall or snowmelt moving over and through the ground



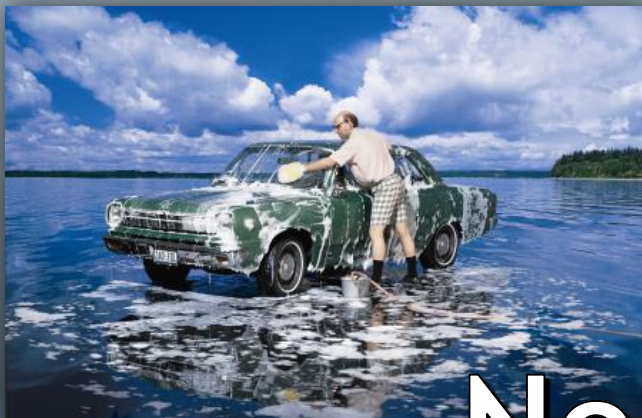
# What Type of Source?



**Point  
Source**



# What Type of Source?



Nonpoint  
Source



# Something to Think About...





# POTW's Publicly Owned Treatment Works

- POTW is a term used for a Sewage Treatment Plant owned, and usually operated by a government agency.
  - City Facilities (Orem, Provo, Springville, Spanish Fork, Payson, Salem)
  - Special Service District (Timpanogos SSD)



# POTW's - What We ARE NOT...

- We are NOT the source of pollution.

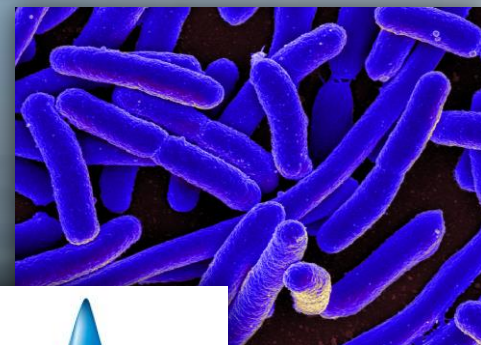


Untreated Point Source Discharge



# POTW's - What We ARE...

- We are PROTECTORS of human health.
- We are RECYCLERS of water.
- We are PROTECTORS of our environment.
- We TREAT to local and national treatment standards.
- We do CARE about our environment.





# The “Do Nothing Option” Has Never Been An Option For The POTW’s

Thank You!





# Utah Lake, Jordan River, and Great Salt Lake System



**Water Quality Regulatory Overview**  
**September 13, 2017**



UTAH DEPARTMENT of  
ENVIRONMENTAL QUALITY  
**WATER  
QUALITY**



WASATCH FRONT  
**WATER QUALITY**  
COUNCIL

# Take Home Messages

- ❑ Utah's waters contribute to high quality of life in Utah
- ❑ Growth requires strategic investment in all elements of water infrastructure
- ❑ Policy makers need to be engaged with water quality issues
- ❑ Water quality issues are complex and related to water development
- ❑ Funding is needed for research to optimize protection of our waters

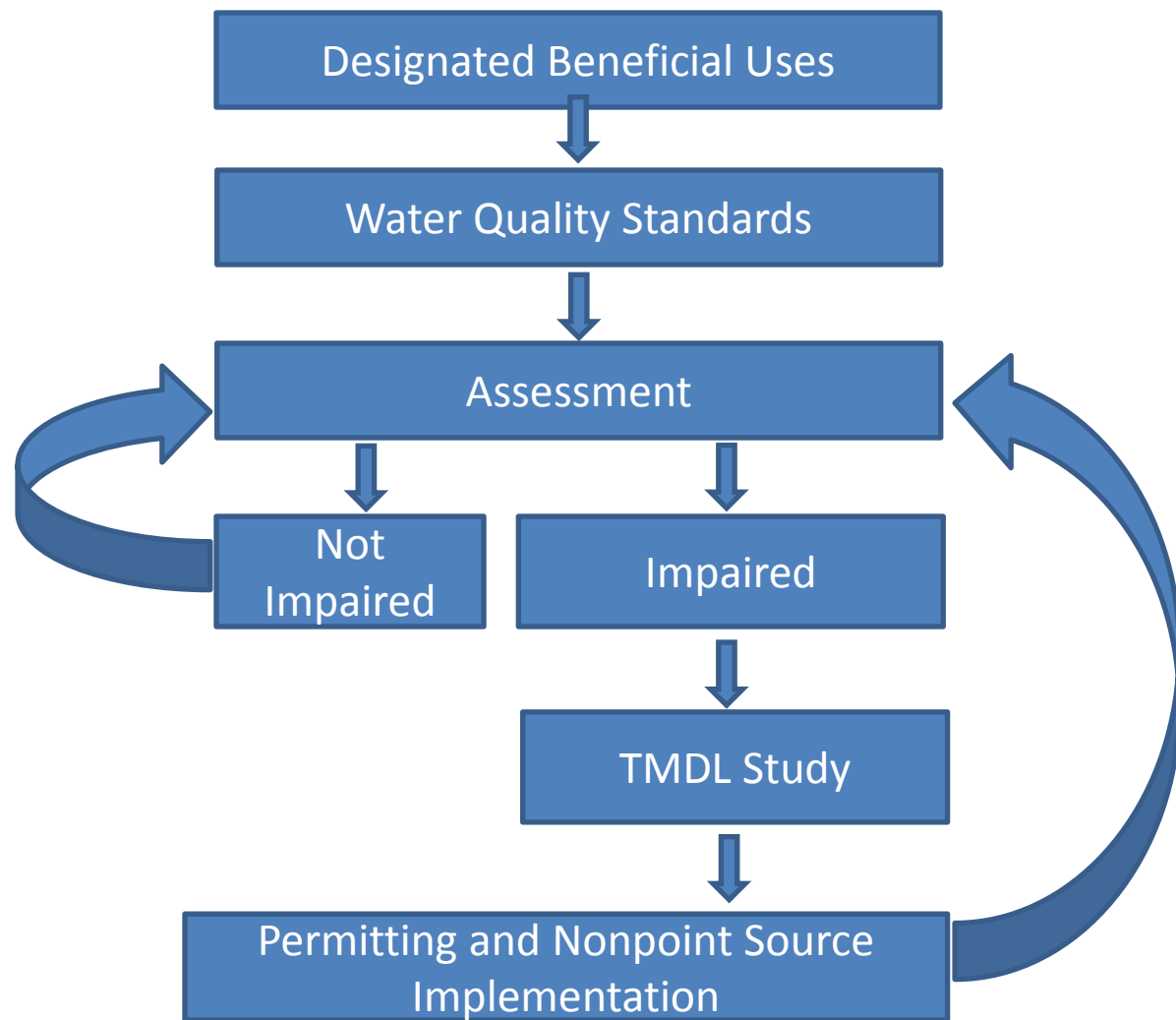


Photo credit: Utah Homebuilders

# Utah's Regulatory Authority to Protect and Restore Water Quality

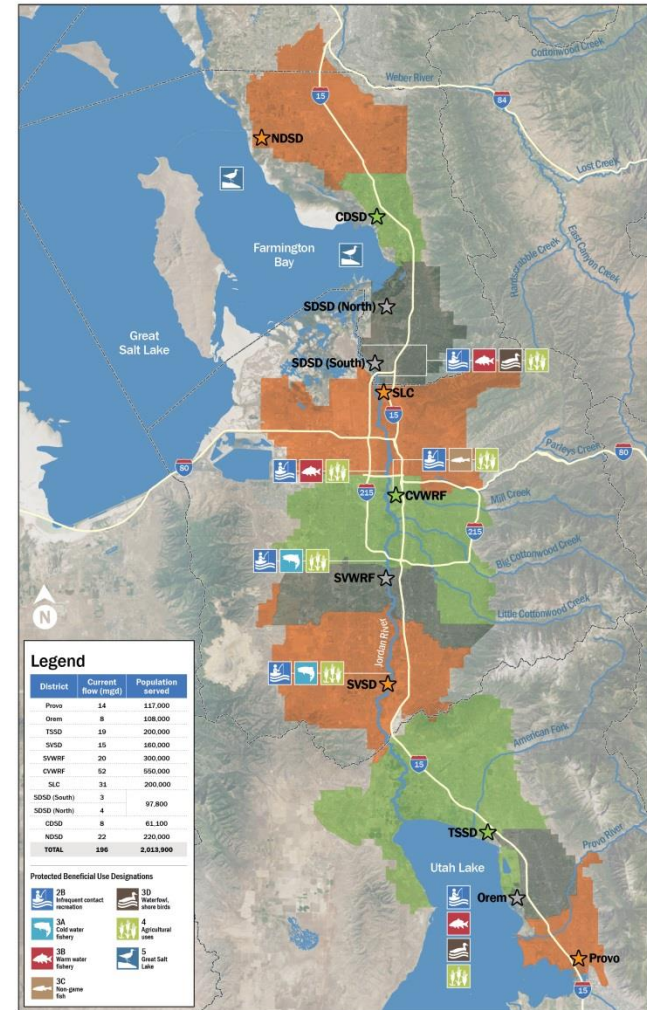
Clean Water Act  
Sections 303, 304, 305,  
and 402 (among others)  
→ Delegated from EPA  
to State of Utah, DEQ

Utah Water Quality Act  
(Title 19-5) outlines  
Powers of Water  
Quality Board and  
Director of Division of  
Water Quality



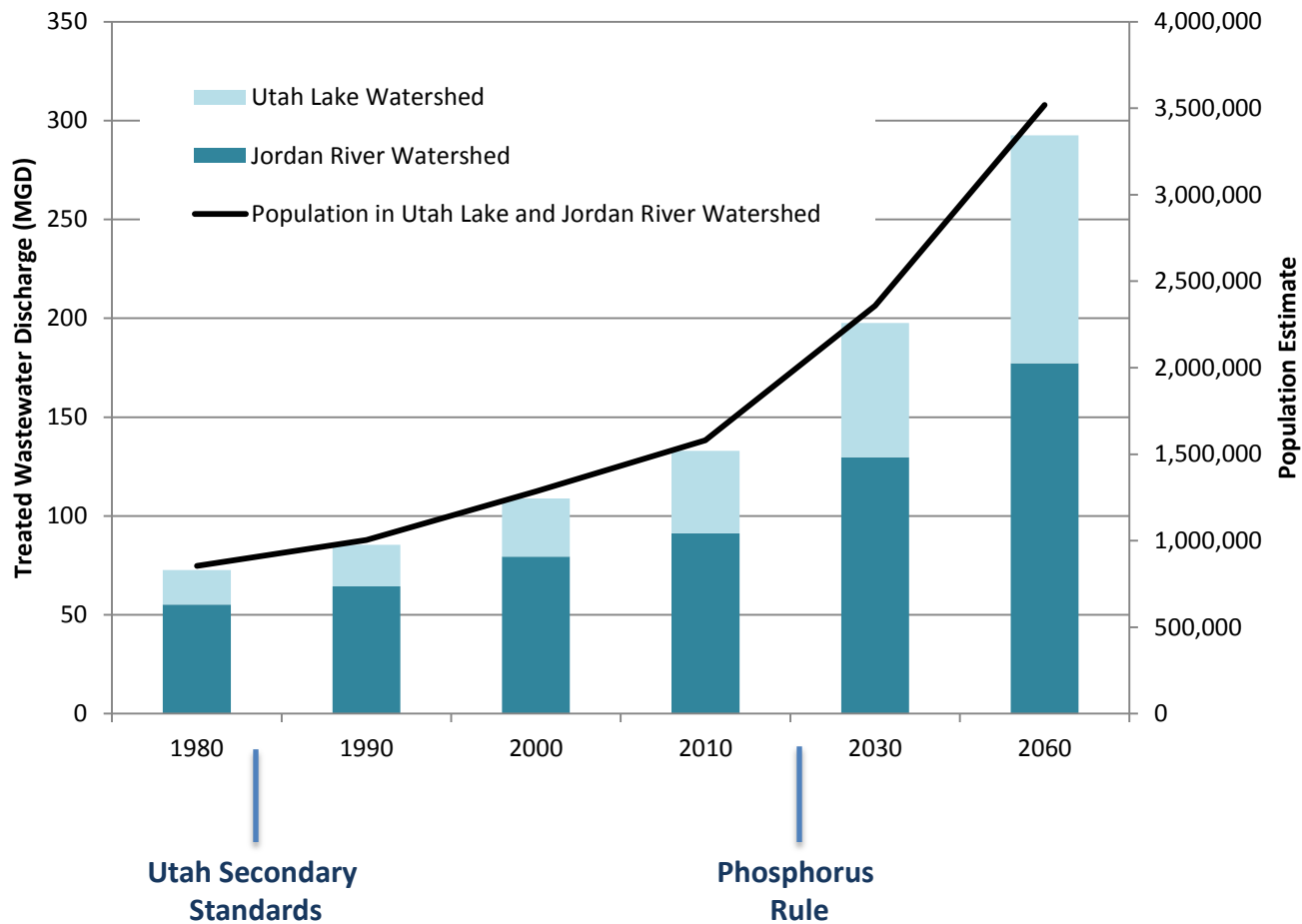
# What is the Wasatch Front Water Quality Council?

- 10 Member POTW Agencies formed Agreement
- \$1.0 Million/year for water quality research
- Inform Legislative initiatives
- Public relations initiatives

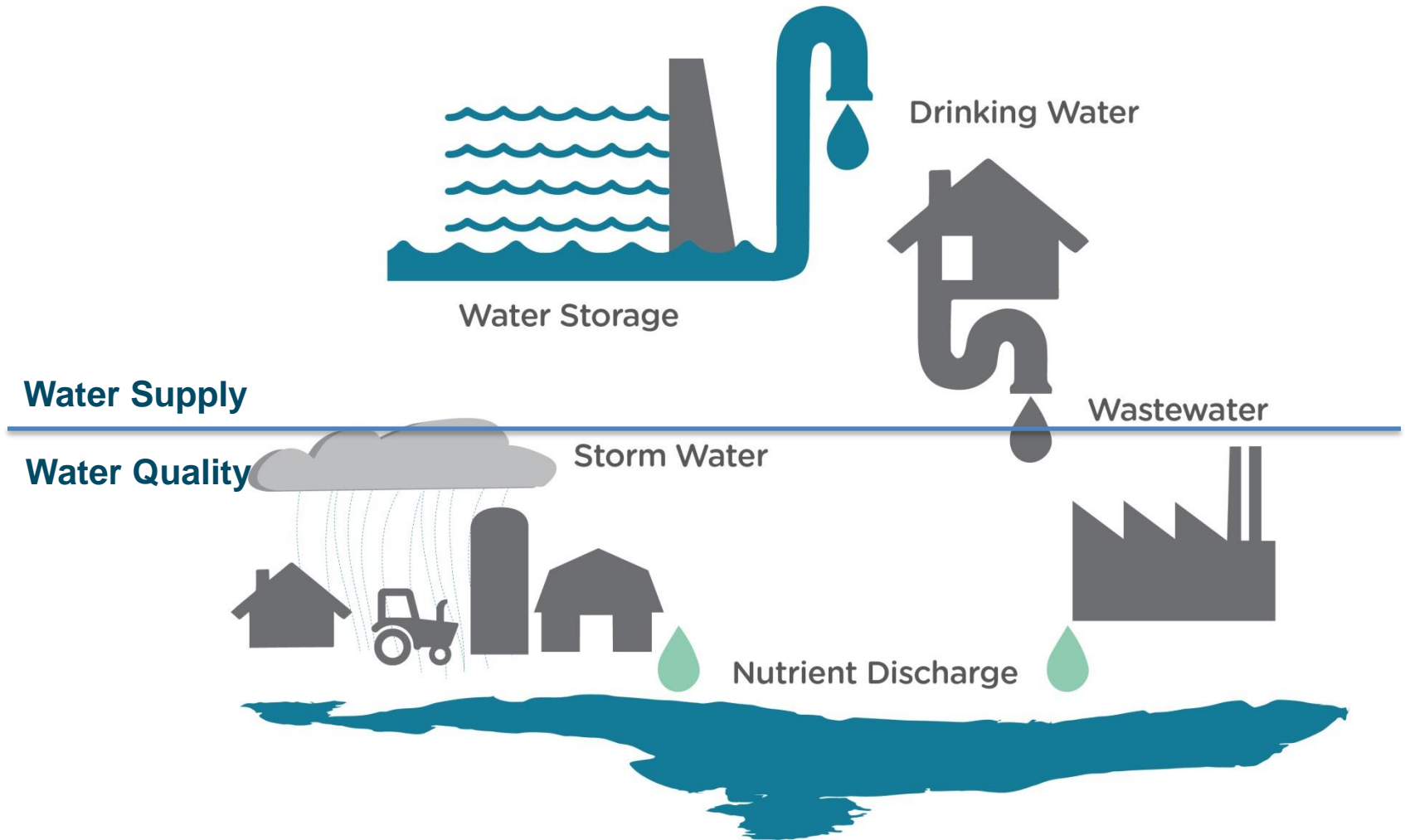




# Utah County Population Growth



# Water Infrastructure



# Nutrient Pollution Threatens Utah Waters



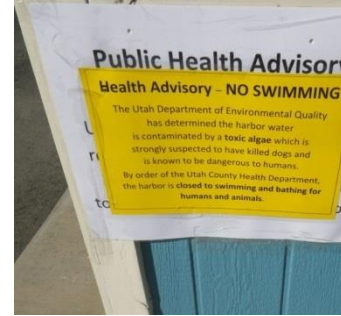
Aquatic life



Aesthetics



Livestock



Recreation



Drinking Water

## ☐ Direct effects

- ☐ High levels of nitrate cause blue baby syndrome.
- ☐ Ammonia directly toxic to aquatic life.
- ☐ Cyanotoxins (Harmful Algae Blooms)

## ☐ Indirect effects

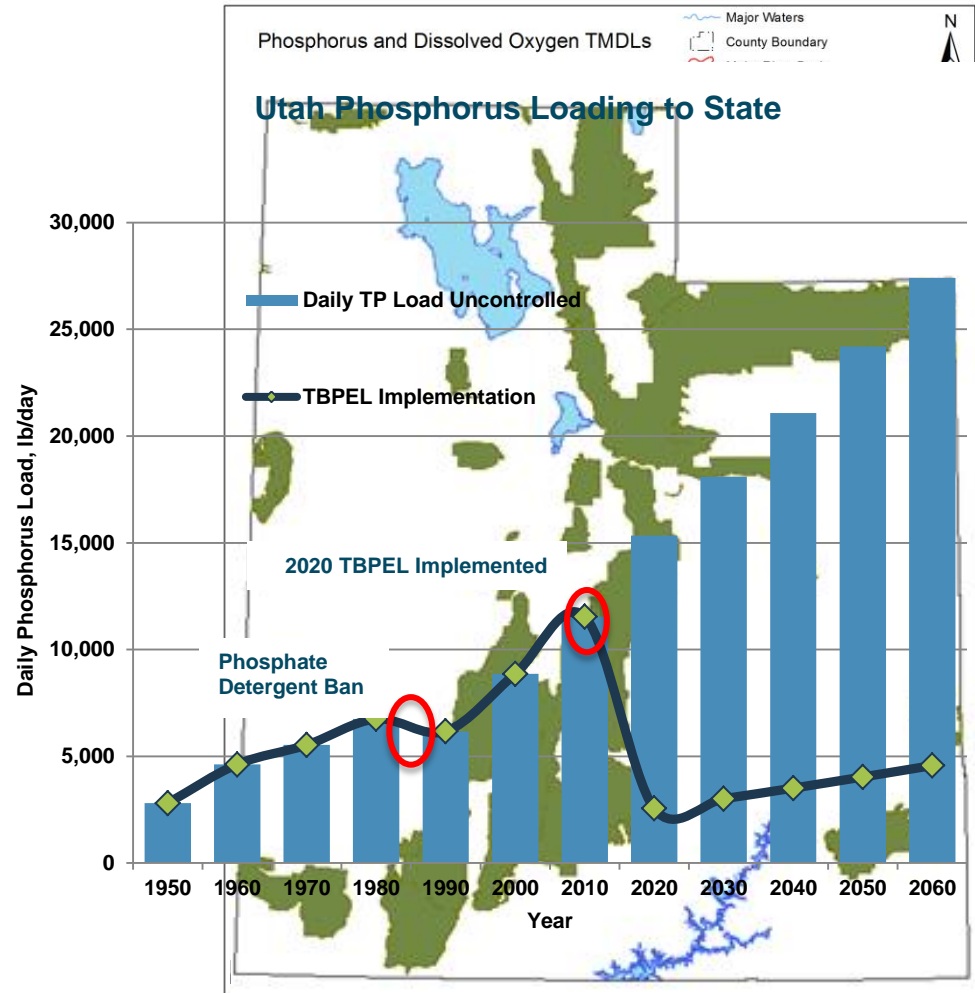
- ☐ In excess, robs waters of dissolved oxygen
- ☐ Results in nuisance and harmful algal blooms
- ☐ Affects taste and odor of drinking water

# Utah's Nutrient Strategy

Headwater Numeric Nutrient Criteria to protect pristine waters

“Hold the Line” state-wide on nutrients with Technology Based Phosphorus Effluent Limit of 1 mg/L by 1/1/2020

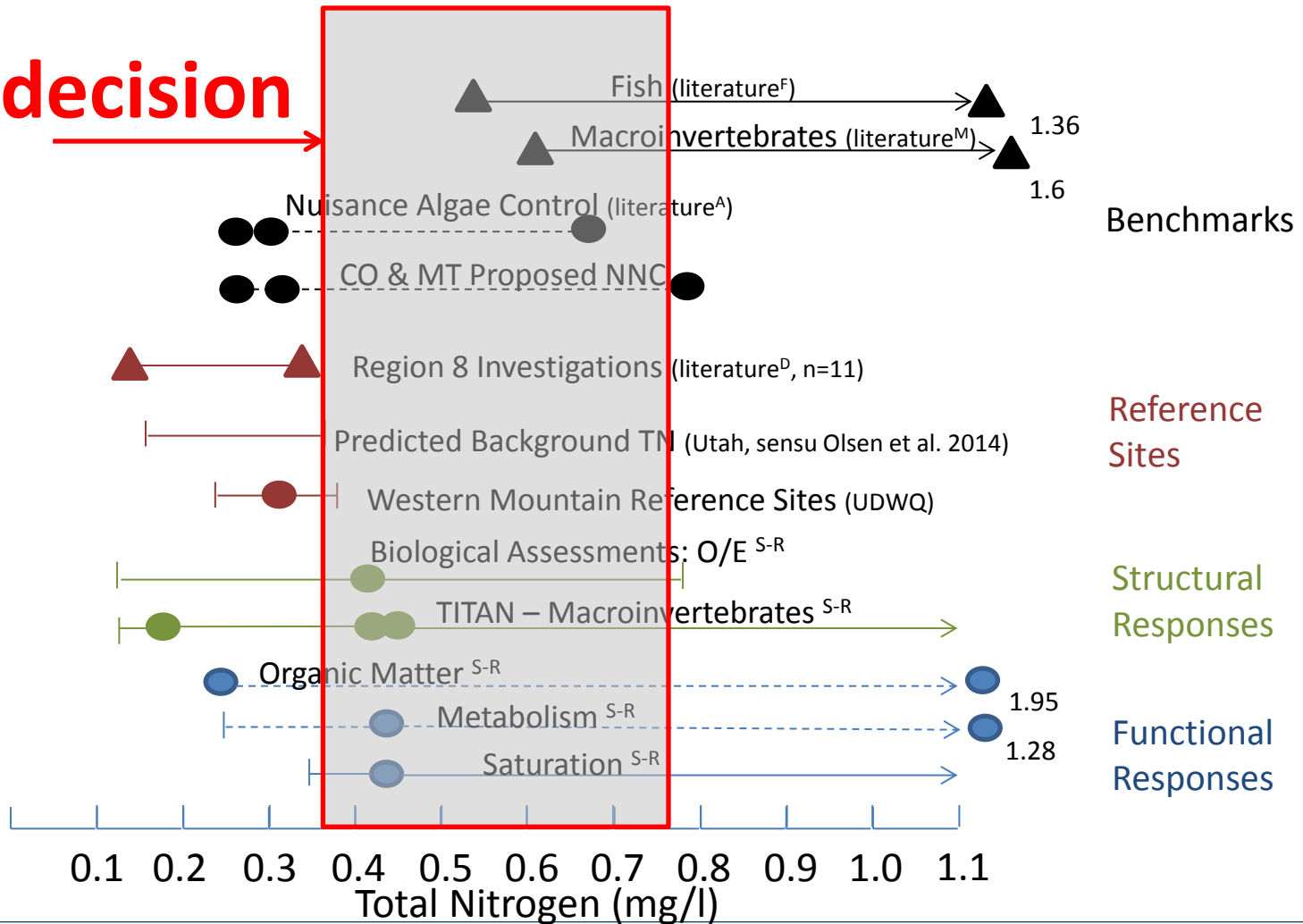
Develop site-specific nutrient standards for major waters





# Role for Science and Policy

**Policy decision**



# The Utah Lake-Jordan River-Farmington Bay-GSL System

- Multiple streams, rivers, and lakes draining to closed system
  - Designated Beneficial Uses
- 2 Million People
  - 50% of Utah's population
- 10 POTW's
  - 200 million gallons per day similar to Weber River



# Water Management Agencies

Agency		Water Supply	Water Quality	Flood Control	Lake/River Management
Utah Department of Natural Resources	Forestry, Fire and State Lands				X
	State Parks				X
	Water Rights	X			
	Water Resources	X			
Utah Department of Environmental Quality	Water Quality		X		
	Drinking Water	X			
Federal Agencies	US Army Corps of Engineers			X	
	Bureau of Reclamation	X			
	US Environmental Protection Agency		X		
Coordinating Bodies	Great Salt Lake Advisory Council				X
	Jordan River Commission				X
	Utah Lake Commission				X
Local Management	Water districts	X			
	Local government	X		X	

# Evaluating Tradeoffs

## Wastewater Infrastructure

Hundreds of millions \$\$

## Storm water systems

Tens of millions \$\$

## Nonpoint source reduction

Tens of millions \$\$

## Opportunity costs

\$\$\$

## Public health

Irritative and potential toxic effects

## Aquatic life

Sport fisheries and Endangered Fish

## Recreation

492,000 trips/year to Utah Lake  
\$1.4 - \$2.4 billion/year state-wide

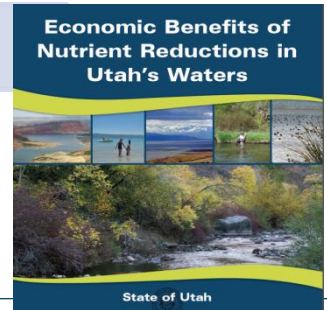
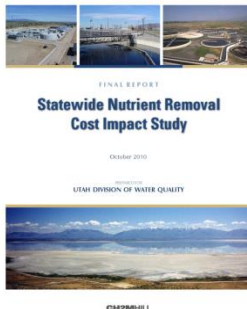
## Secondary water

Salt Lake and Utah Counties



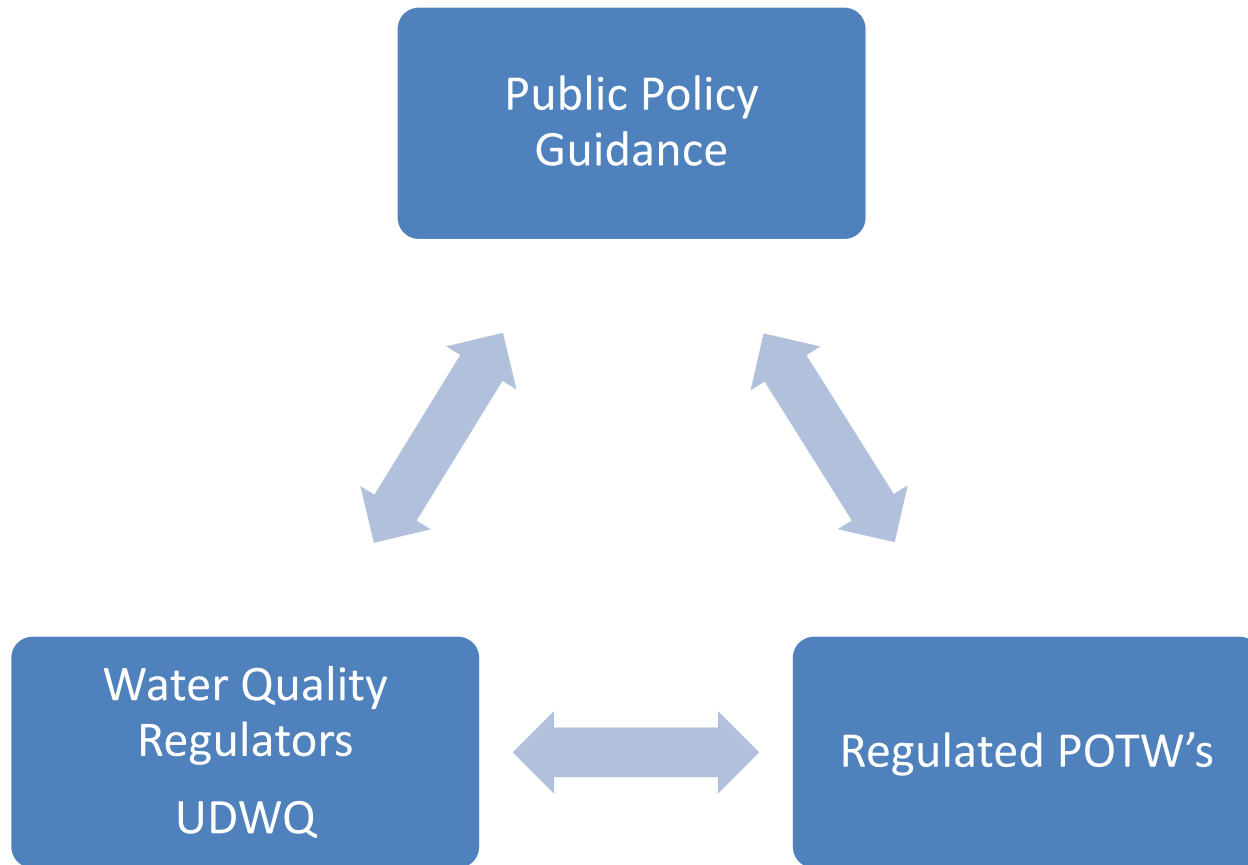
# Costs

# Benefits



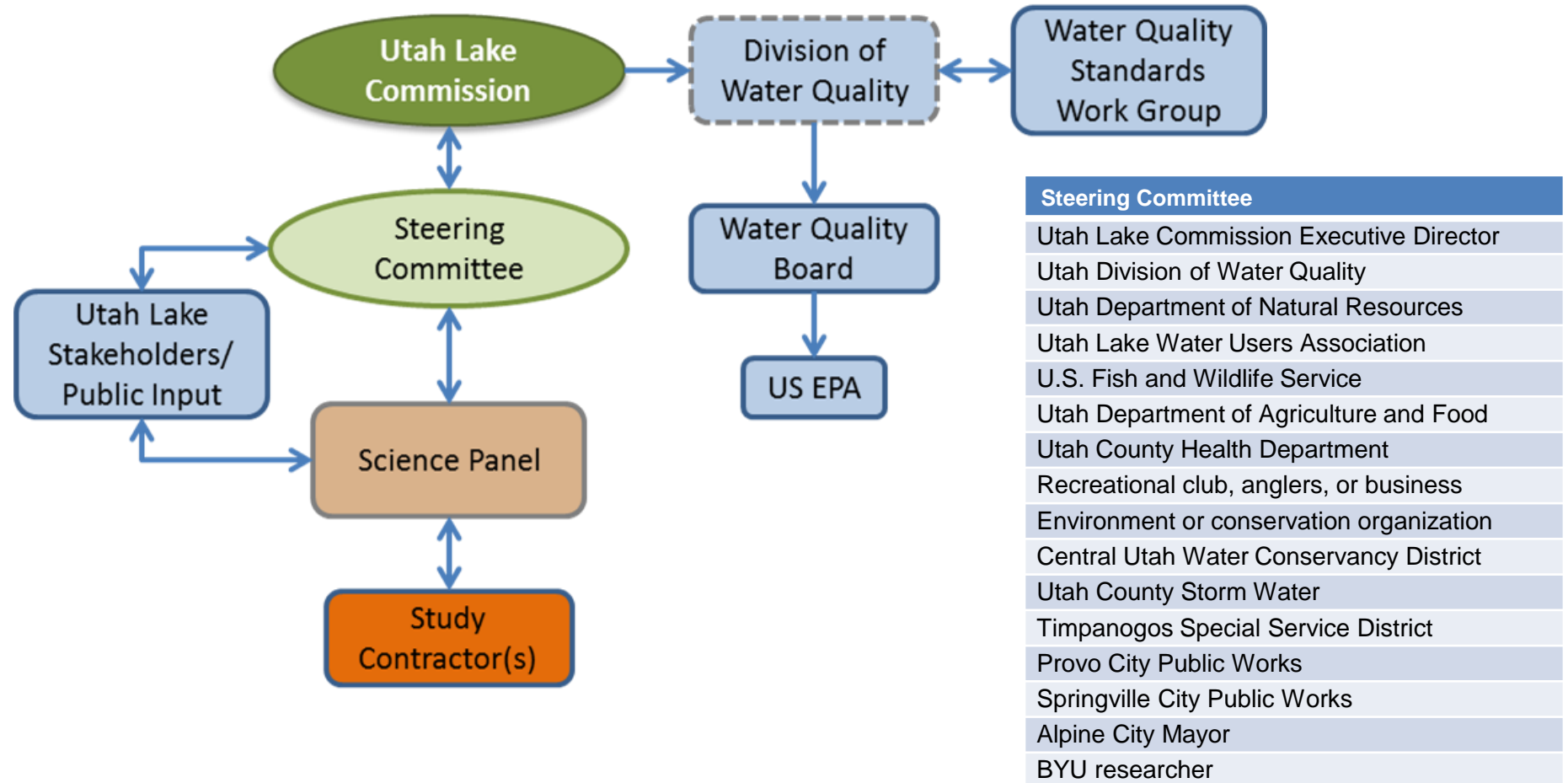


# This Complex System Warrants Public Policy Guidance

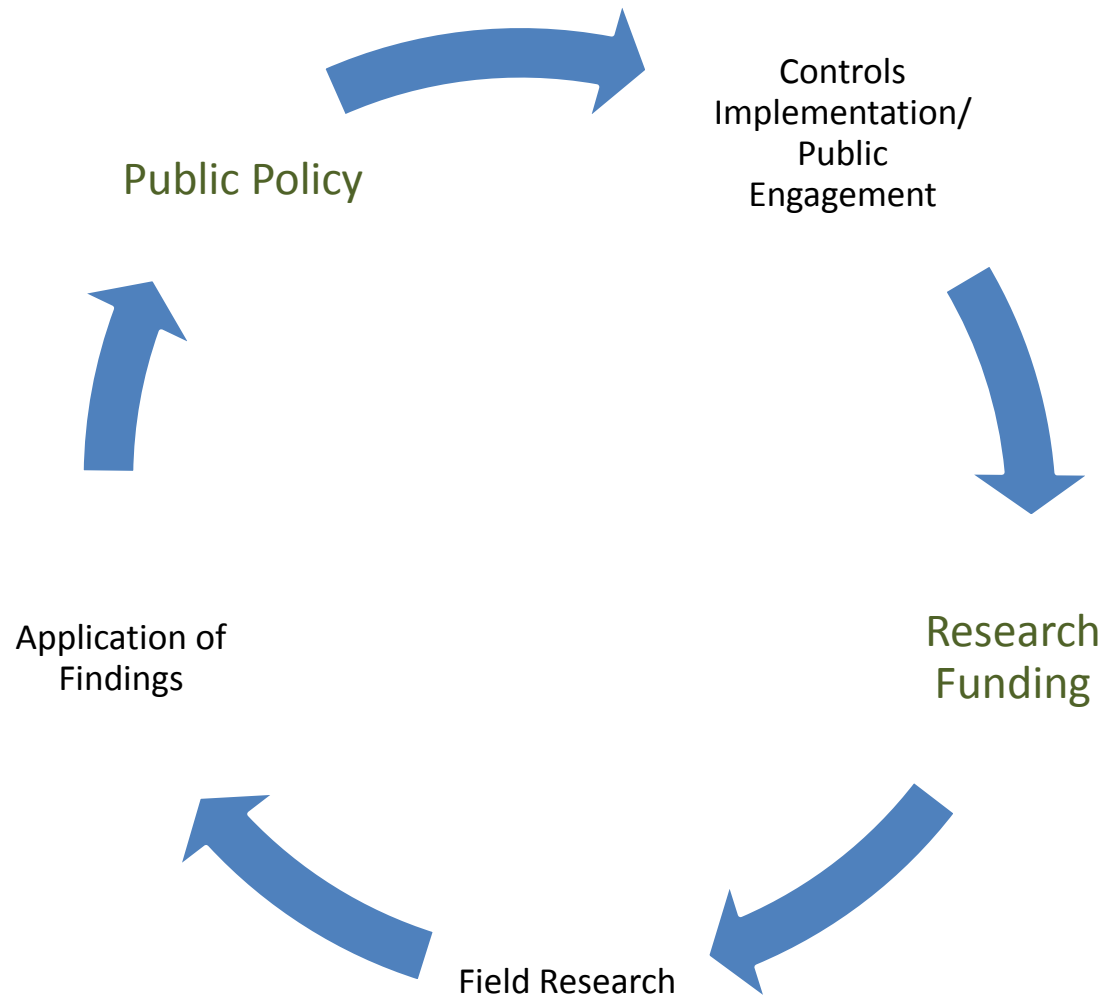


# Utah Lake Water Quality Study

Purpose: Develop recommendations for any necessary in-lake water quality criteria that are protective of designated uses and sustain natural resources of Utah Lake



# What we need....





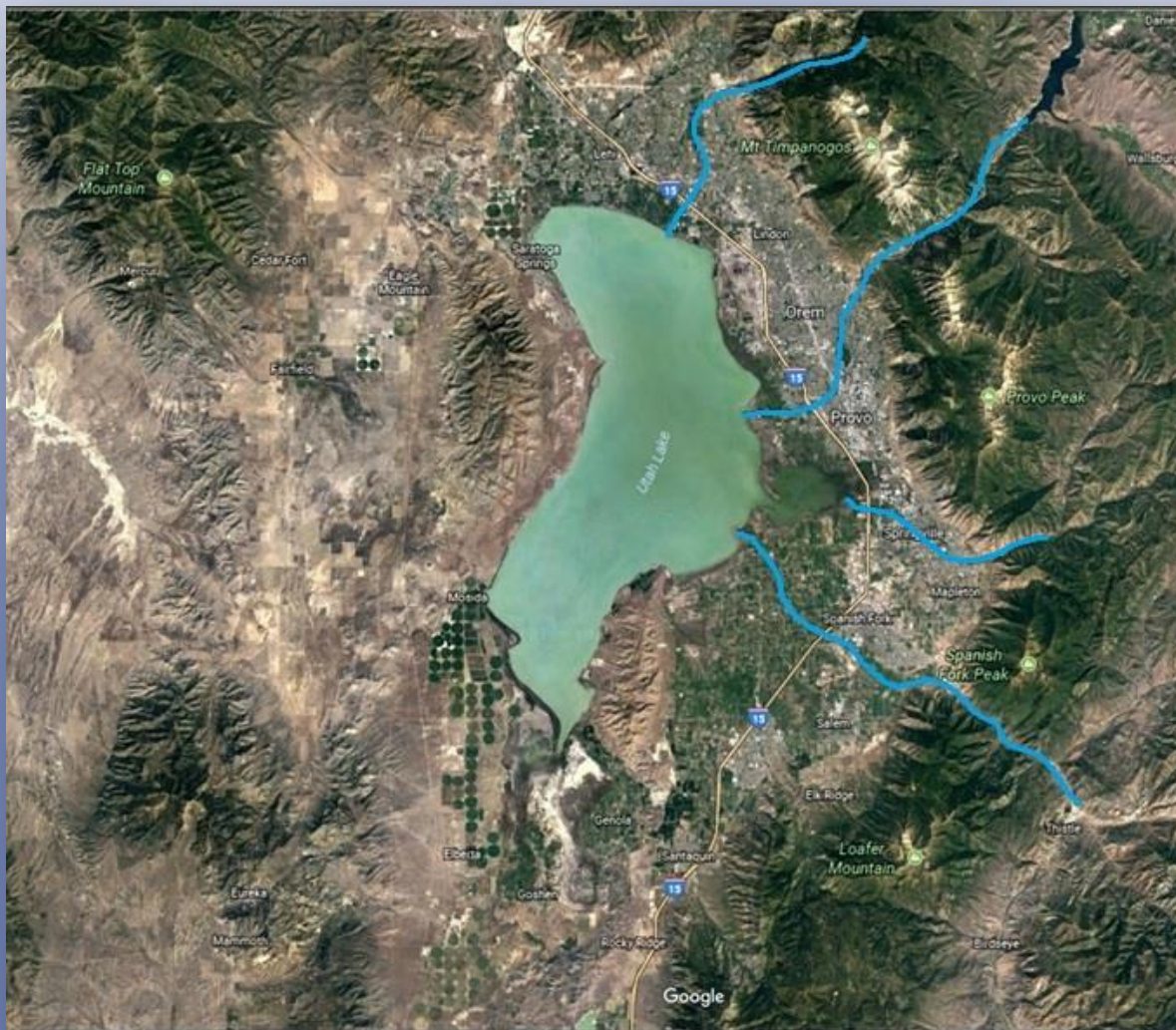


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# Holistic Assessment of Pollution Control Measures

Brian Selck  
PWTP

# Watershed



# Point Sources

POTW's

Industrial Discharge

Stormwater (not treated)



# Point Source Monitoring

- Before permits are renewed, the State evaluates point sources and issues limits based on that evaluation.
- This process is used to determine what can be discharged to a waterbody without affecting its beneficial uses.

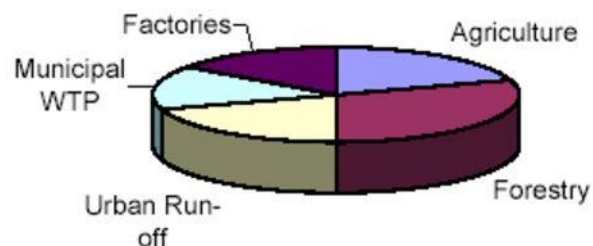


# TMDL

## *(Total Maximum Daily Load)*

- Used to determine the sources and amounts of pollution that are entering a waterbody that does not support their beneficial uses.
- Calculations are made based on the TMDL to determine how much each source would have to reduce their input so that the waterbody meets state water quality standards and support its beneficial uses.

A TMDL is the pie, load allocations are the pieces of the pie.



# Nonpoint Source Monitoring

- Data Collection...

# Main Non-point Sources

- Direct precipitation
- Agriculture Runoff
- Groundwater
- Any non-permitted discharge
- **Most significant source of water pollution in the United States**



# TMDL - continued...

- A TMDL allocates allowable loads to a waterbody from different contributors
- POTW's are the most readily regulated industry
- More research is needed to understand the issues facing our environment.
  - POTW's throughout the Wasatch Front are already contributing their own funding for research.



# POTW's Clean the Water

# 2020 Rule

- Phosphorus <1 mg/L  
(Technology Based Effluent Limitation)



# Other Environmental Impacts



# Key Takeaways

- The solution is not solely through regulation of POTW's
- This is a public problem, doing nothing was never an option.
- We need the legislature to be involved and we need more research.
- We are all publicly funded entities and are all using public dollars.



The background features a light blue gradient at the top, transitioning into a dark blue section at the bottom. Two horizontal stripes, one light blue and one dark blue, separate the top and bottom sections. On the left side, there are several translucent blue bubbles of various sizes. The text "Thank You!" is centered in the dark blue bottom section.

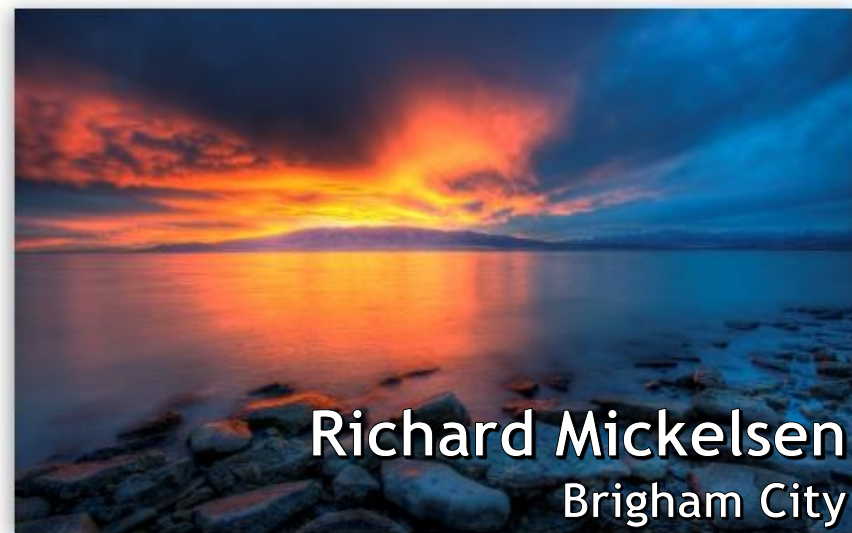
**Thank You!**





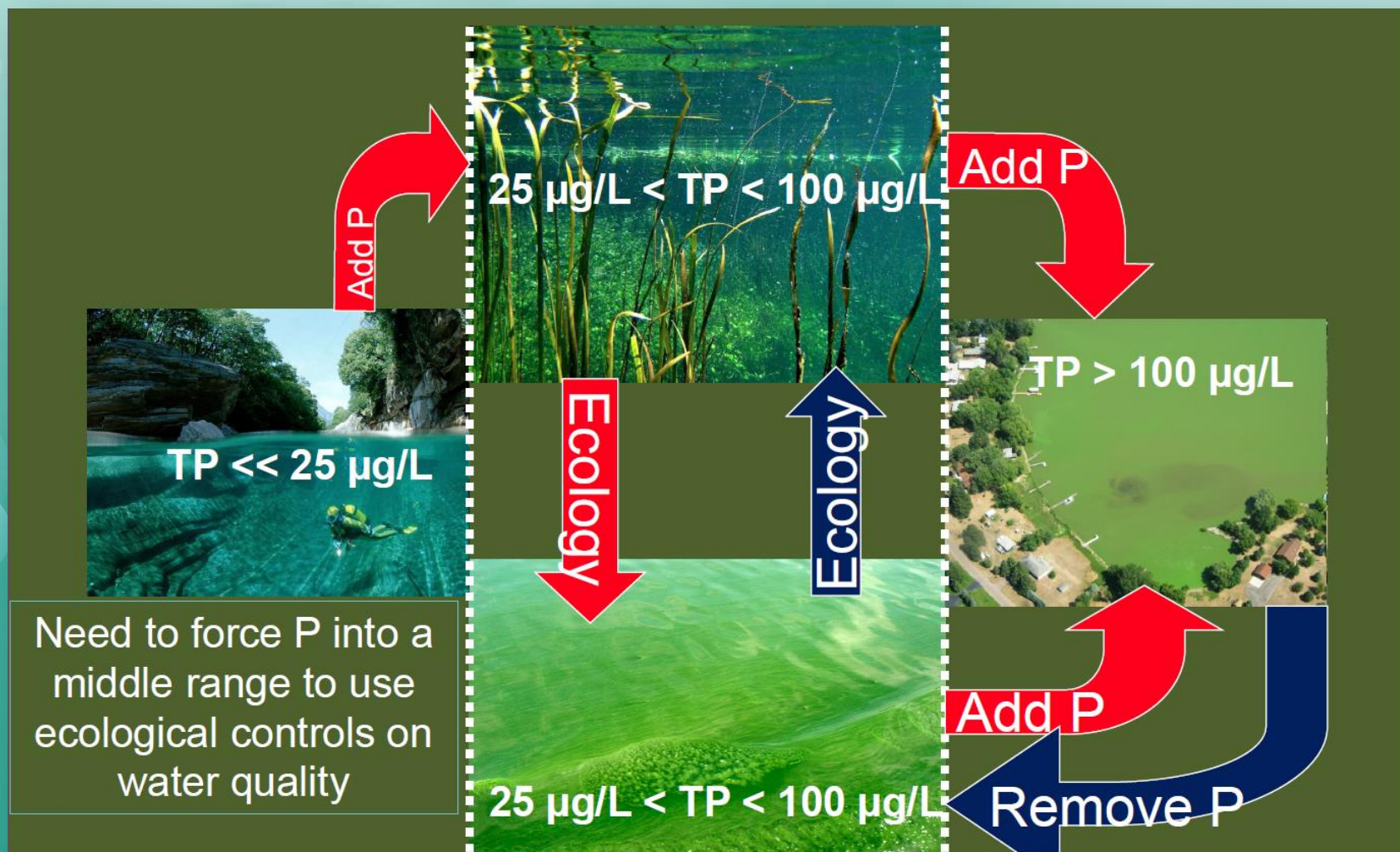
# Utah Lake

## Summary of Water Quality Research



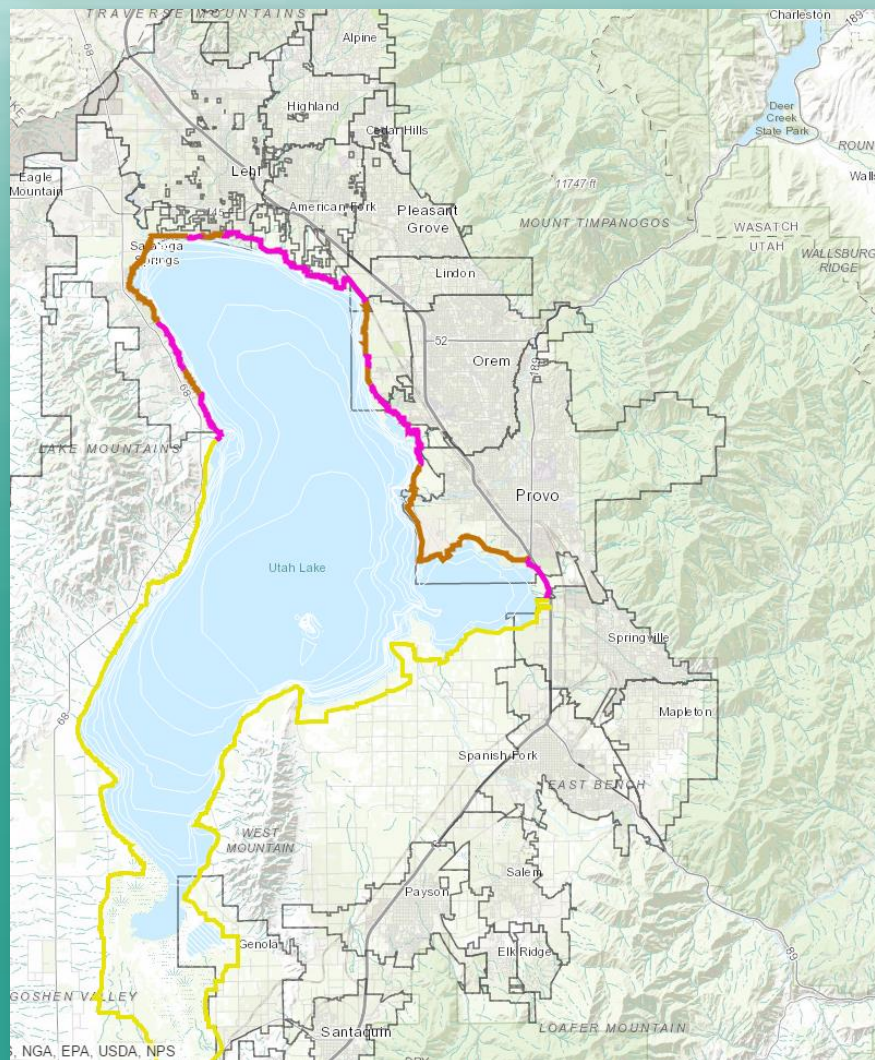
**Richard Mickelsen**  
Brigham City

# Alternative Stable States





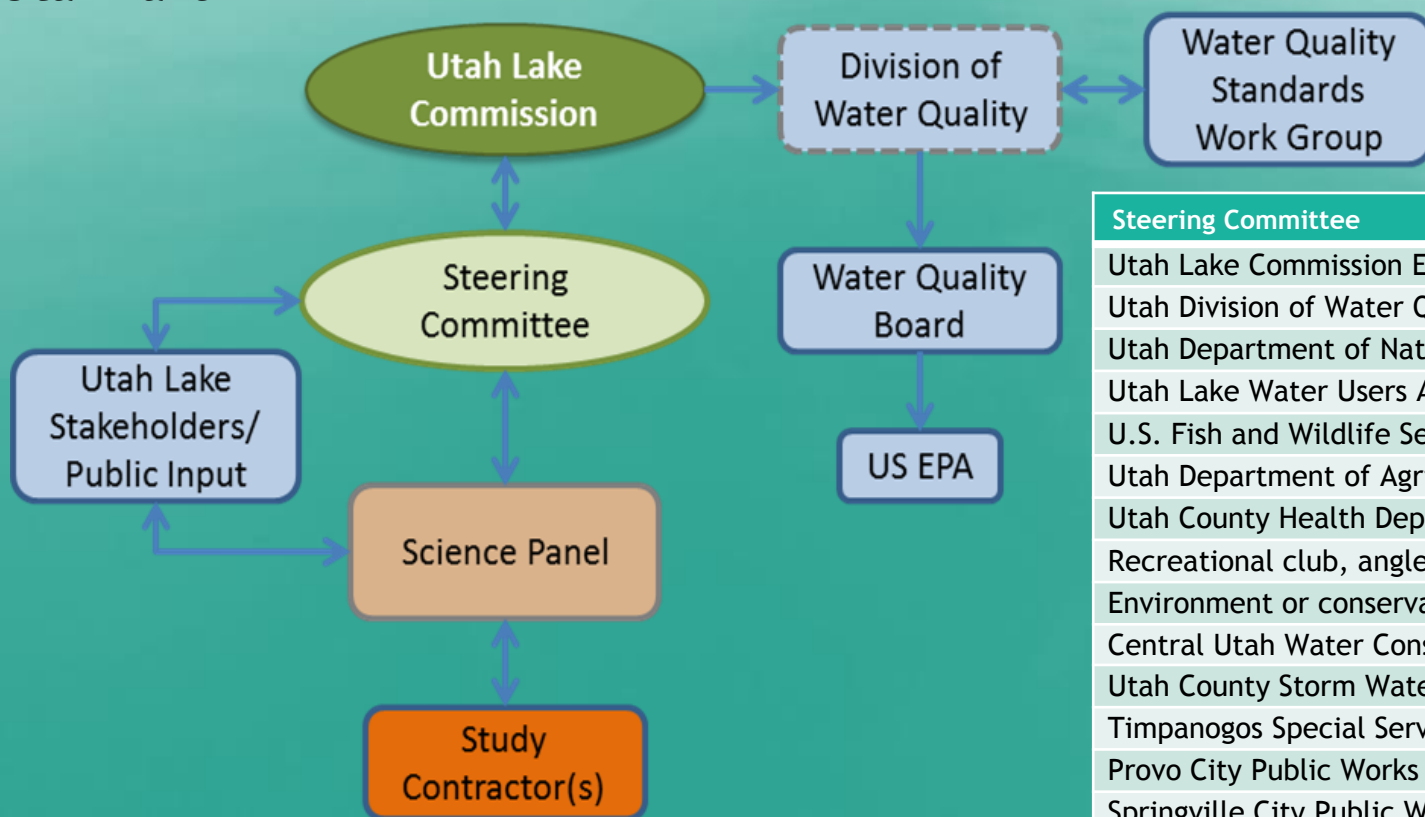
# Utah Lake Basin



# Utah Lake Quality Study

## Purpose:

Develop recommendations for any necessary in-lake water quality criteria that are protective of designated uses and sustain natural resources of Utah Lake

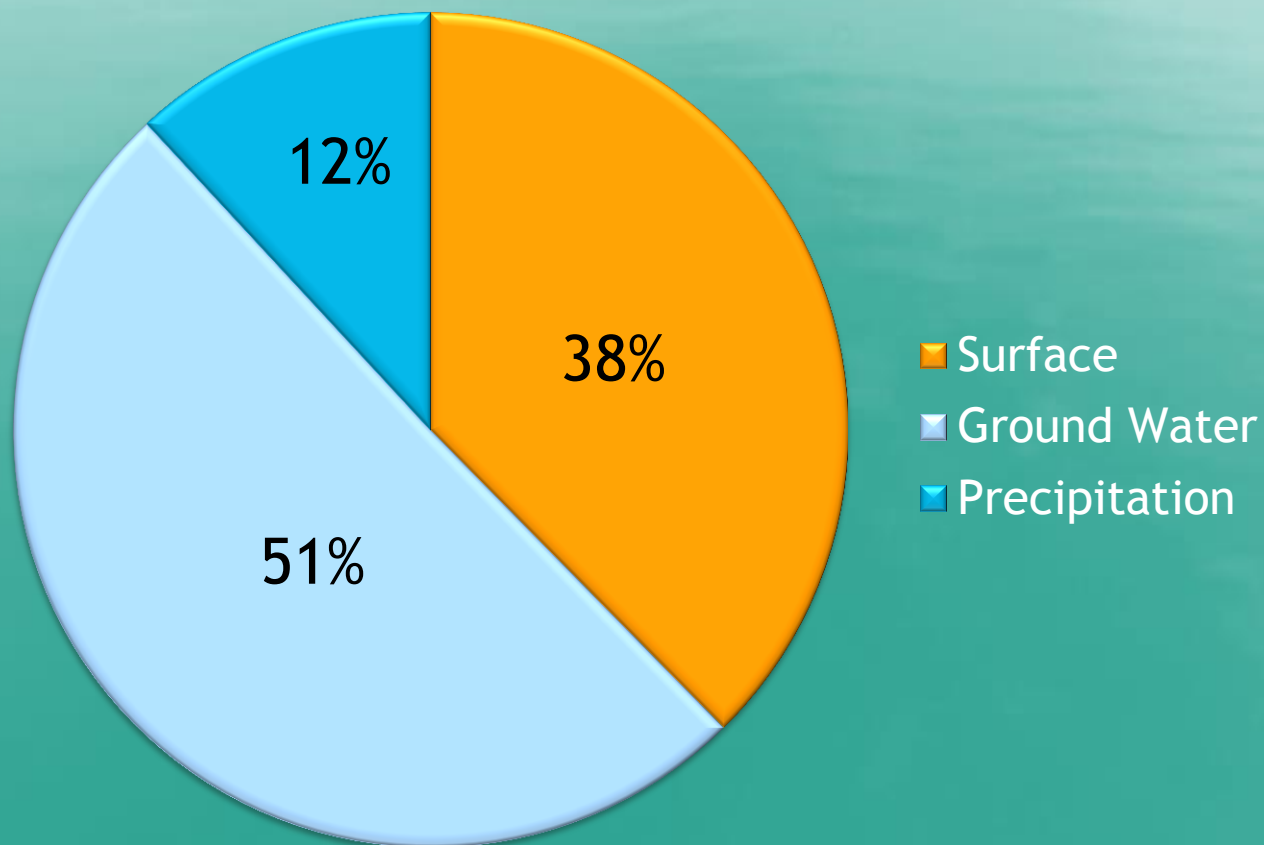


### Steering Committee

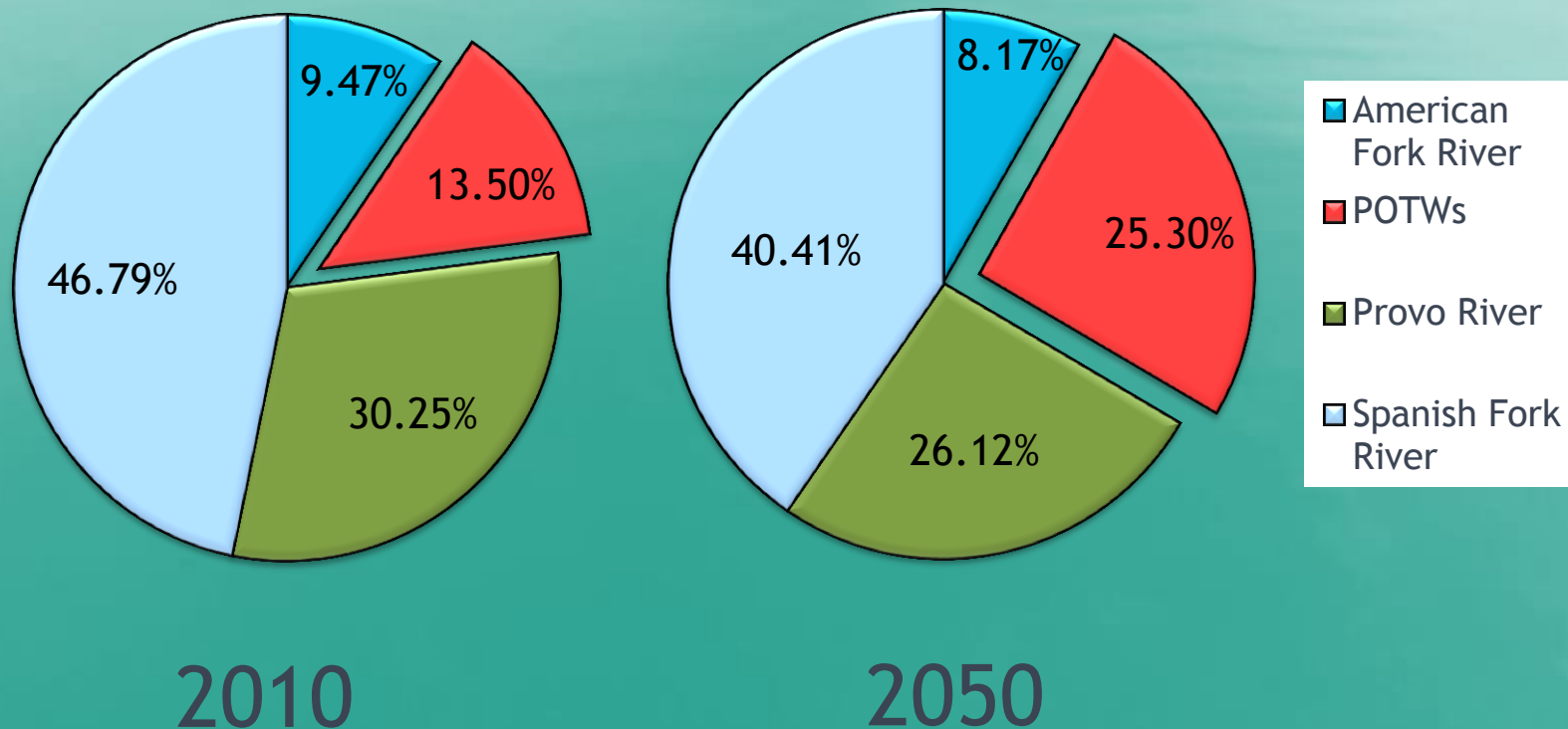
Utah Lake Commission Executive Director
Utah Division of Water Quality
Utah Department of Natural Resources
Utah Lake Water Users Association
U.S. Fish and Wildlife Service
Utah Department of Agriculture and Food
Utah County Health Department
Recreational club, anglers, or business
Environment or conservation organization
Central Utah Water Conservancy District
Utah County Storm Water
Timpanogos Special Service District
Provo City Public Works
Springville City Public Works
Alpine City Mayor
BYU researcher



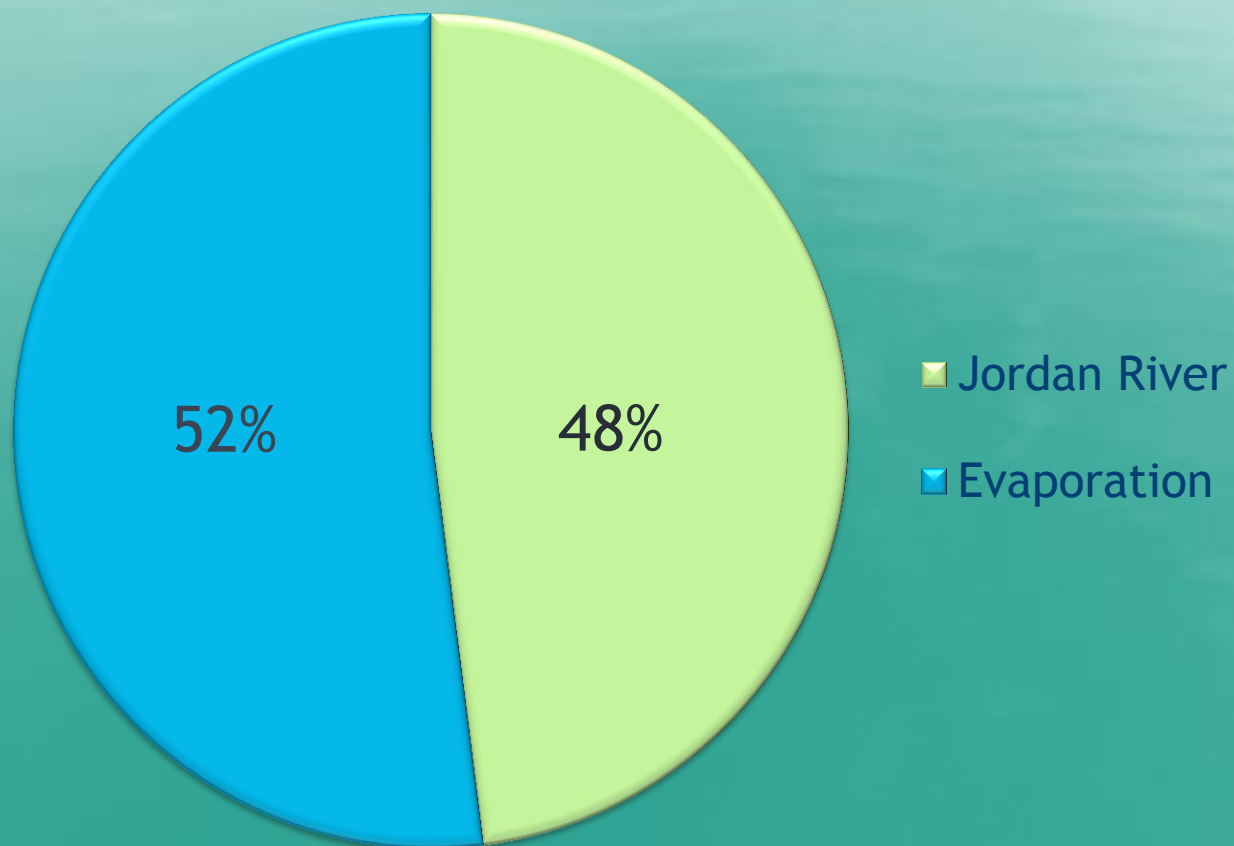
# Utah Lake Water Sources



# Utah Lake Major Inflows



# Utah Lake Out Flow



# Lake Eutrophication - *Oligotrophic Lakes*



An oligotrophic lake or water body is one which has a relatively low productivity due to the low nutrient content in the lake. The waters of these lakes are usually quite clear due to the limited growth of algae in the lake. The waters of such lakes are of high-drinking quality. Such lakes support aquatic species who require well-oxygenated, cold waters such as lake trout.

# Lake Eutrophication - *Mesotrophic Lakes*



Lakes with an intermediate level of productivity are called mesotrophic lakes. These lakes have medium-level nutrients and are usually clear water with submerged aquatic plants.

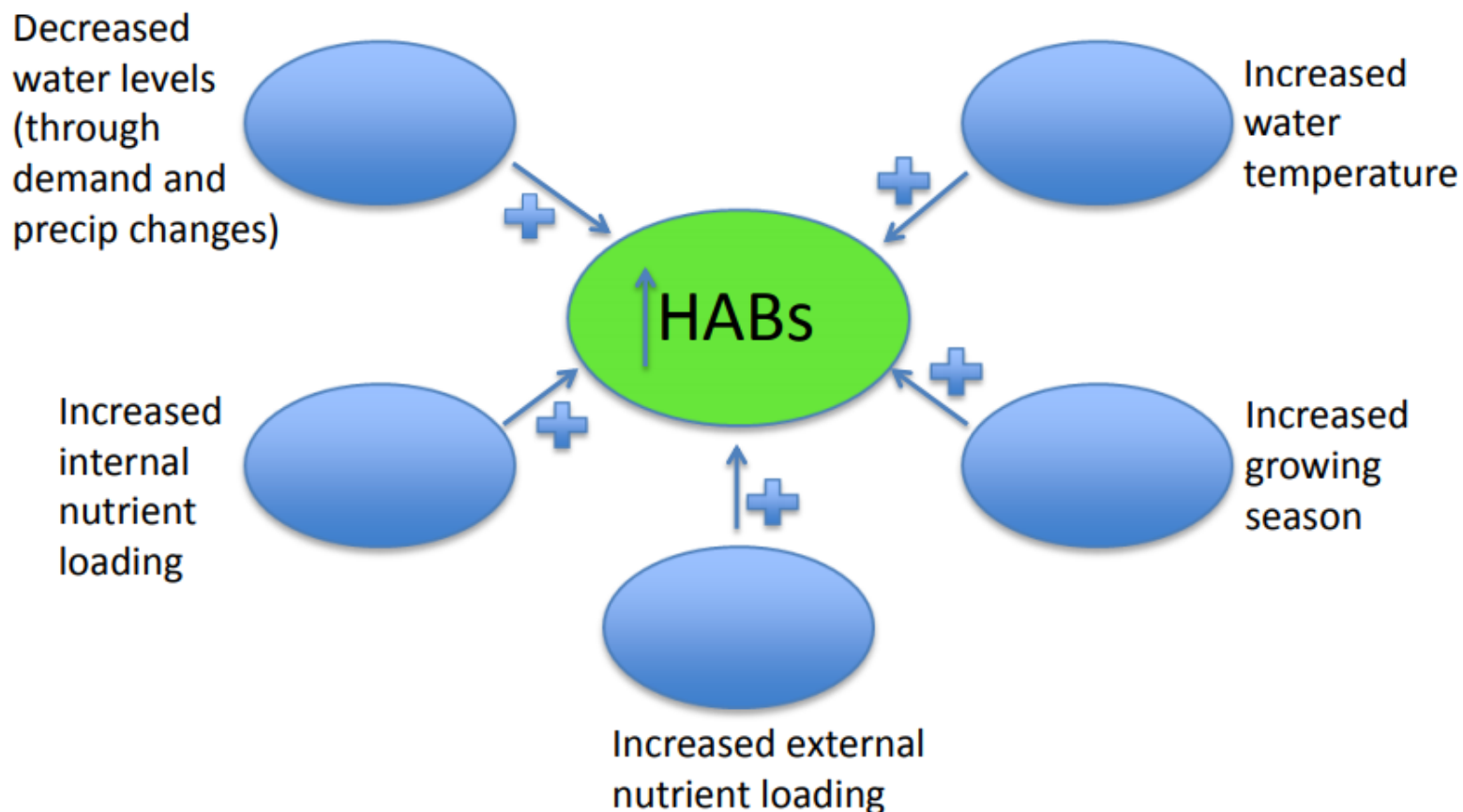


# Lake Eutrophication - *Eutrophic Lakes*



Lakes that are eutrophic in nature have high levels of biological productivity. An abundance of plants is supported by such lakes due to the rich nutrient constitution, especially nitrogen and phosphorus. Initially, eutrophic lakes accelerate multiplication and growth of lake fauna due to the high levels of oxygen provided by a large number of plants growing in the lake.

# Multiplier Effects of Temperature & Nutrients



# Cyanobacteria and Their Toxins (cyanotoxins)

- Liver, nerve, or skin toxins
- Selectively produced by many genera but not very predictable
- Widely distributed but not often at acutely toxic levels
- Analyses are available for some *but not all* of these toxins



*Dolichospermum*  
*(Anabaena)*

-Microcystins (liver)  
-Anatoxin-a/a(s) (nerve)  
-Saxitoxins (nerve)



*Microcystis*

-Microcystin (liver)  
-Toxin is most common and easily measured  
-160 congeners



*Cyndrospermopsis*

-Cyndrospermopsins (liver)  
-Saxitoxins (nerve)  
-Benthic/epiphytic rather than planktonic



*Nodularia*

-Nodularin (liver)  
-Found in brackish water including bays of Great Salt Lake



*Aphanizomenon*

-Anatoxin-a (nerve)  
-Cyndrospermopsins (liver)  
-Saxitoxins (nerve)



# Toxicity Test Strips



- Easy-to-use strip tests (or ‘dipsticks’) detect cyanotoxins: if the sample contains toxin over the U.S. EPA health advisory or WHO (World Health Organization) limits, the test will detect them even if there are no visible algal cells in the sample.

# The Big Three

The Big Three

Plankton

Midges

Chytrid fungi

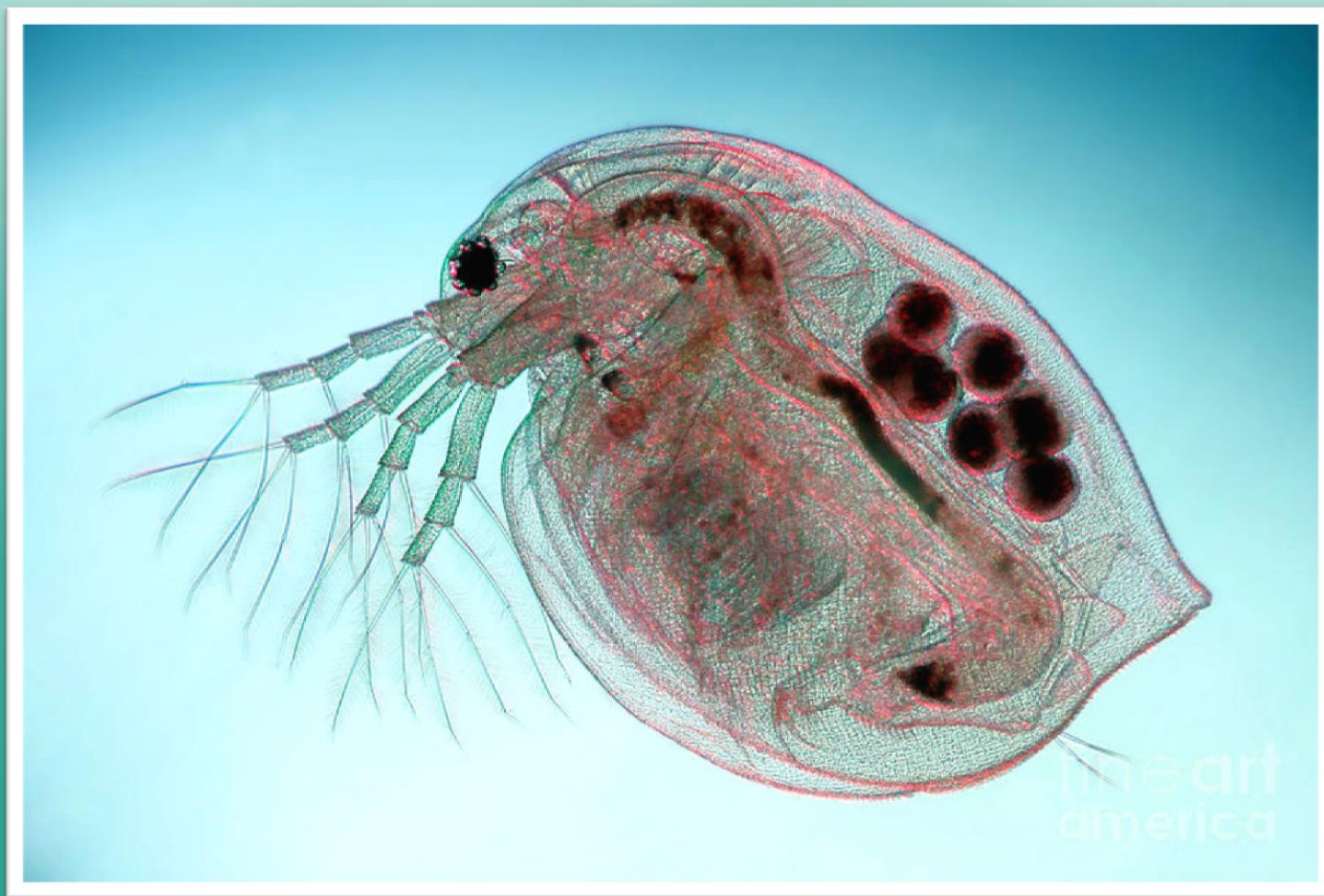
Fish

Microbes

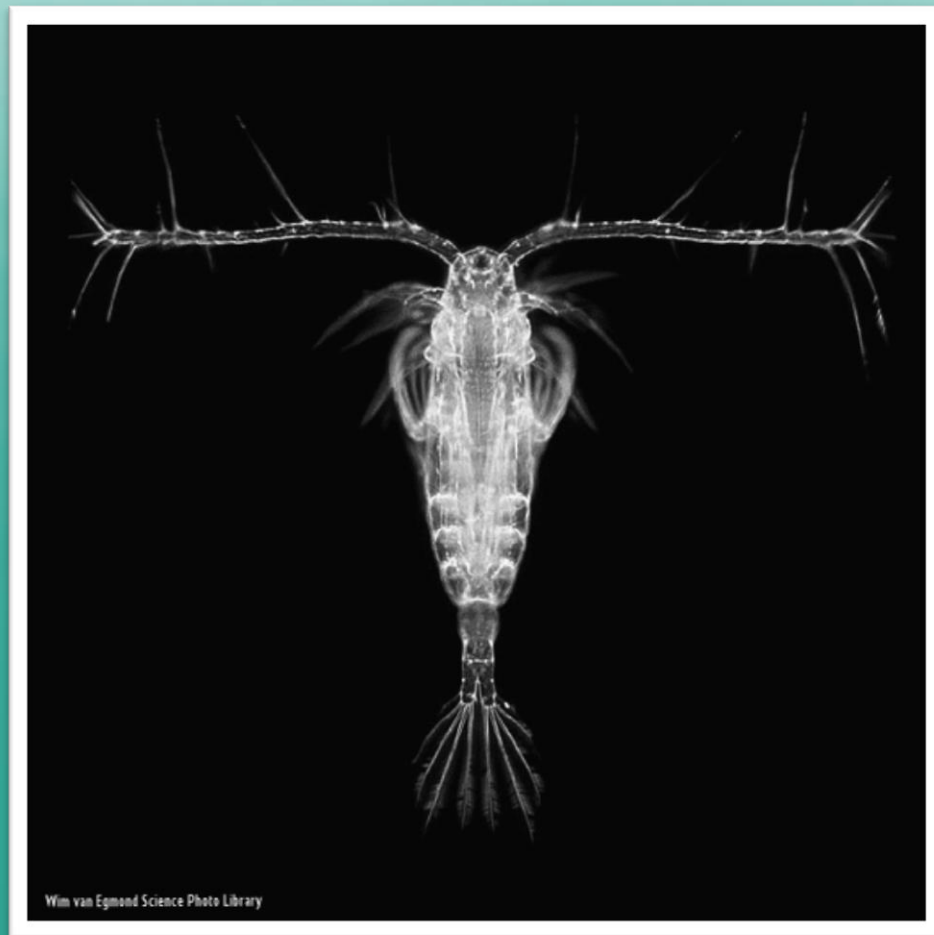




# Daphnia

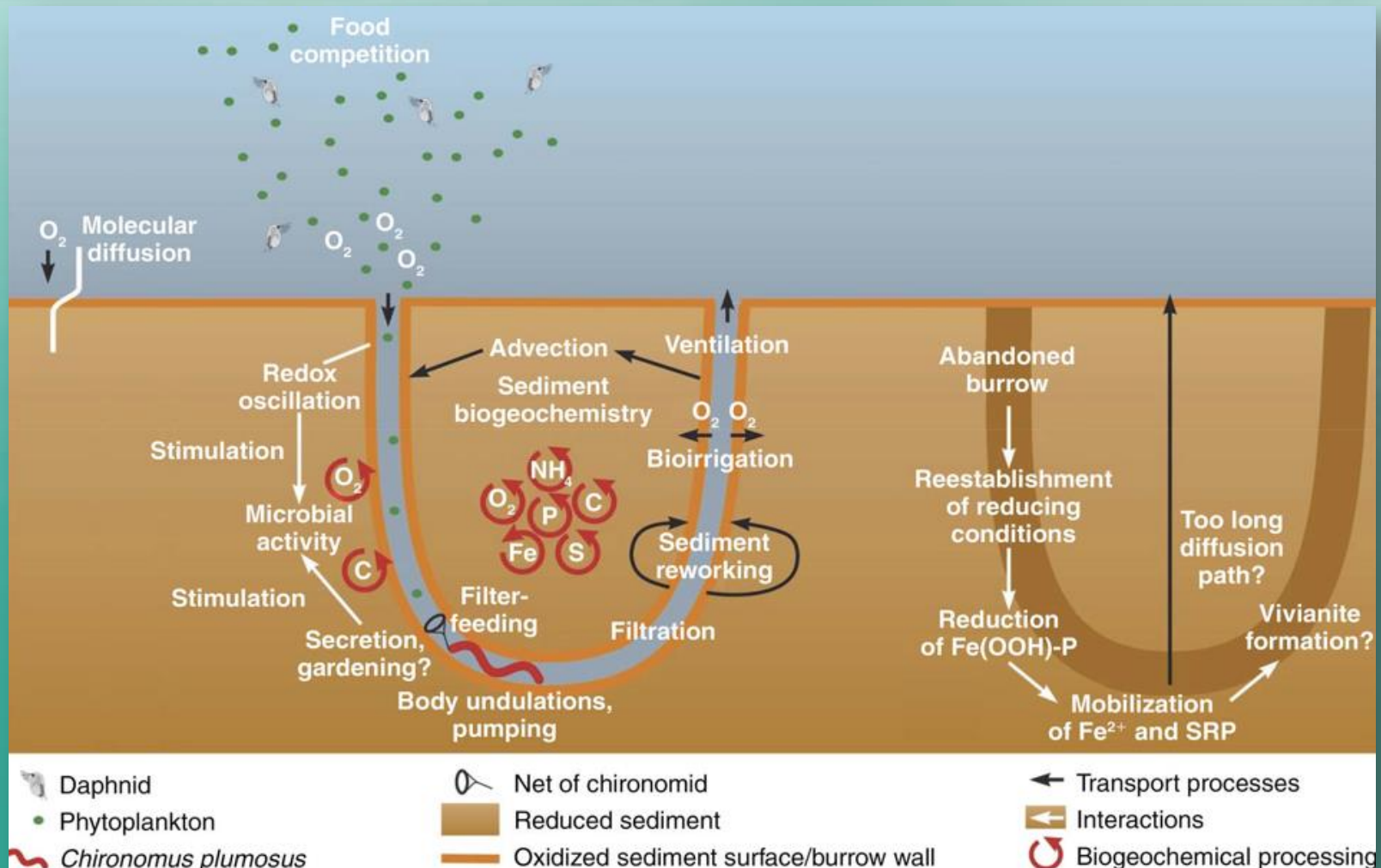


# Copepod



Wim van Egmond Science Photo Library

# Tiny Ecosystem Engineers at Work



Holker et al. 2015. Tube-dwelling invertebrates: tiny ecosystem engineers has large effects in lake ecosystems.



# The Mighty Midge...

## Utah Lake's Link to the Outside World



# UL: Mollusk Centric Food Web

## *Way Back When/Recently Then*

- Mussels and clams (bivalves) = filterers
- Snails (gastropods) = scraper/grazers
- 17 historic taxa
  - A true unique molluskan hotspot



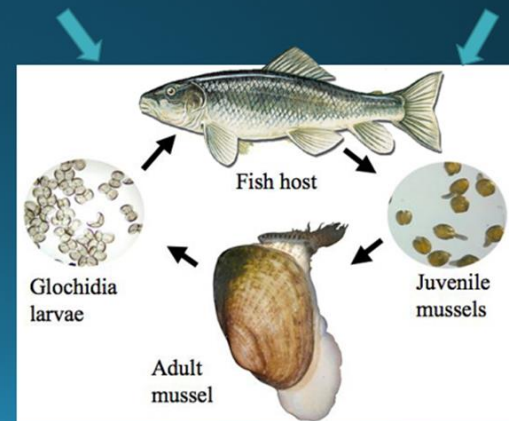
*Grazers*



*Filterers*

Fingernail clam

Anodonta

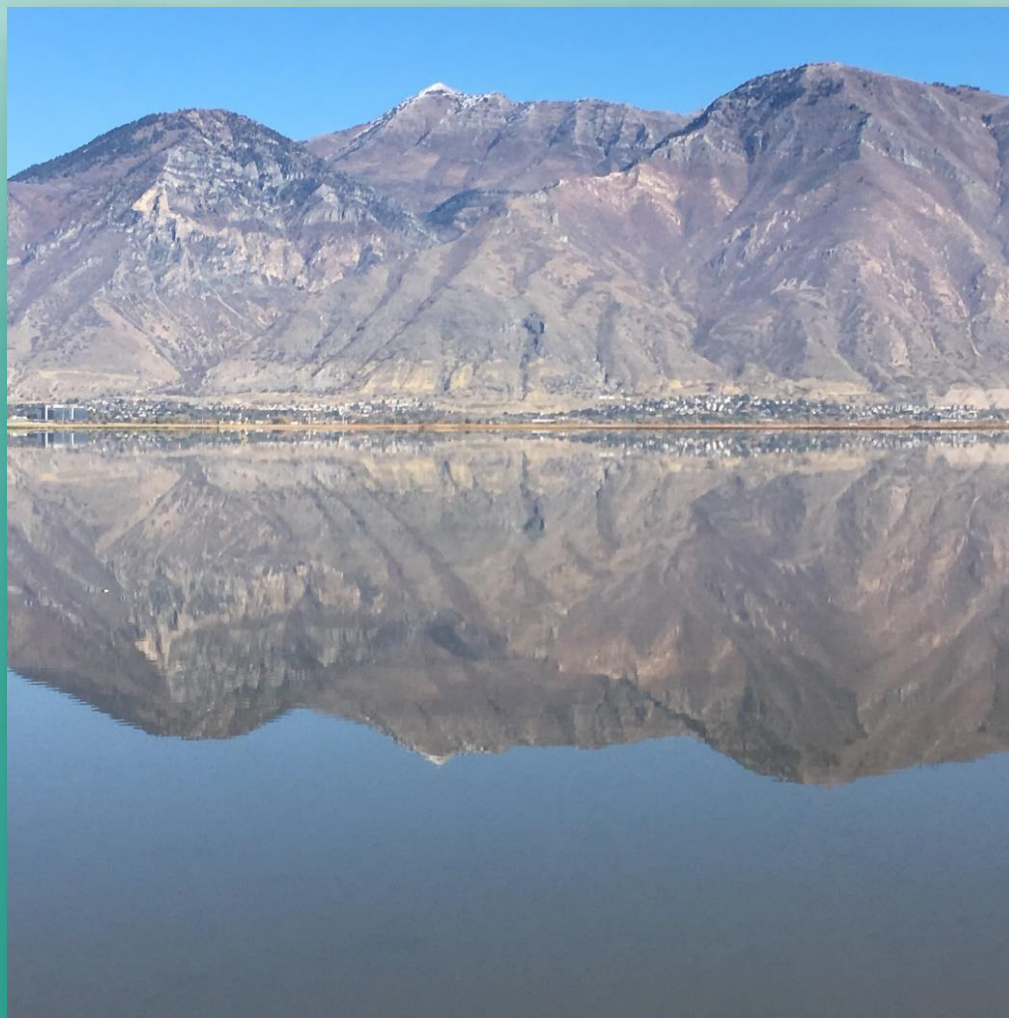




# Remnants of an Era Gone By...



# Provo Bay - 2016





# Provo Bay - 2016

## *Chironomid Tunnels*



# Provo Bay - 2016

## *Wetlands*

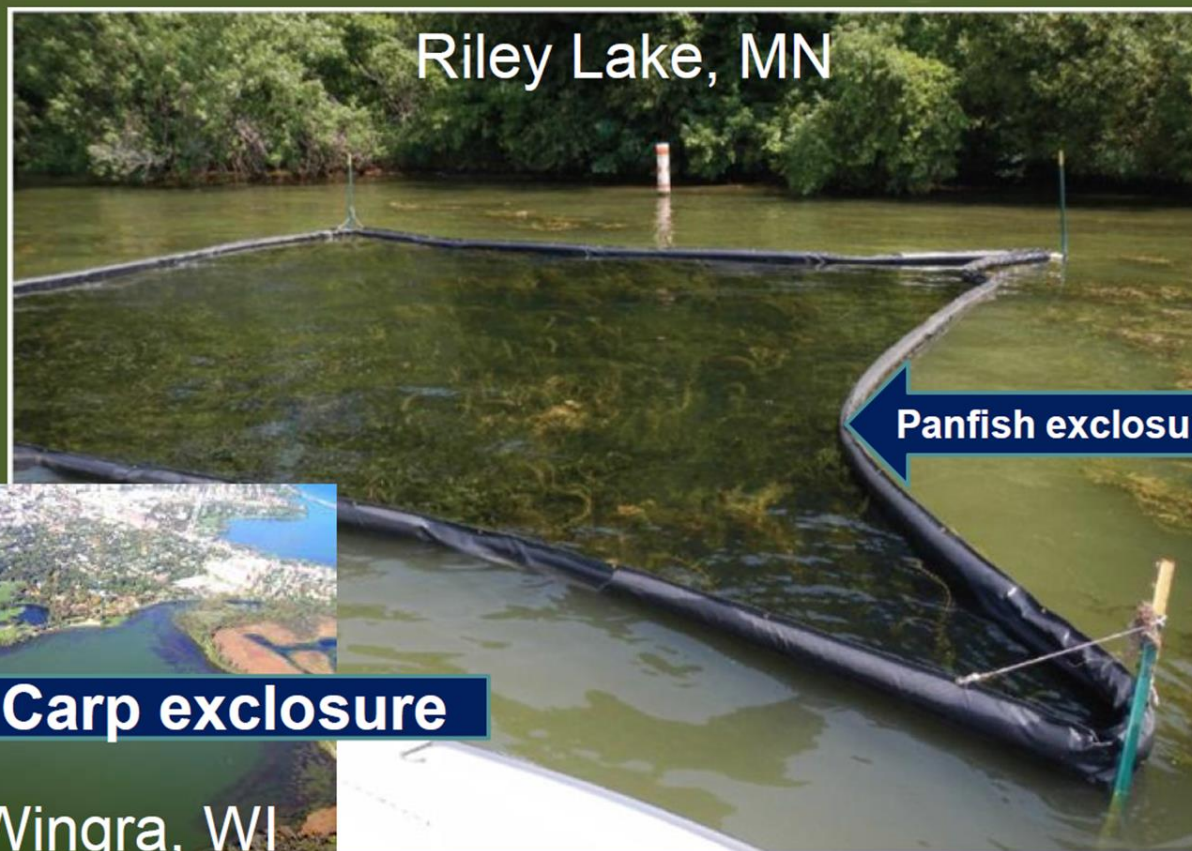


# Utah Lake Fish



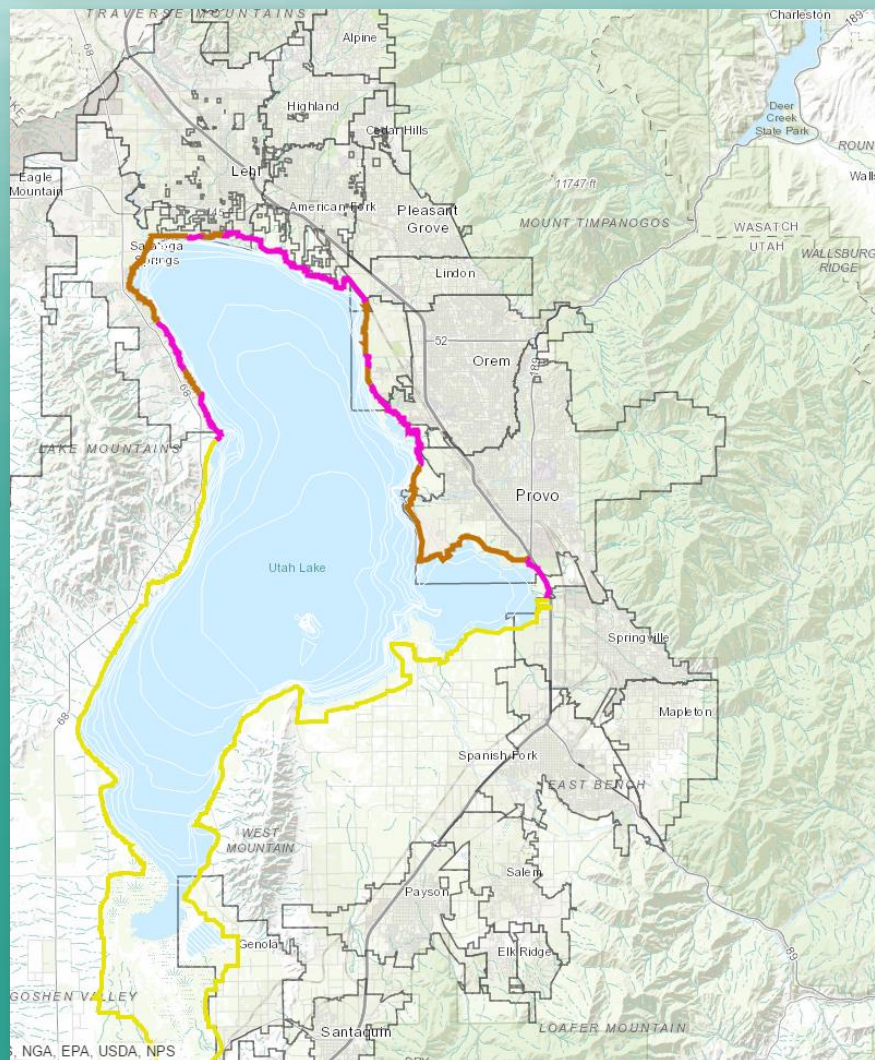


# Alternative Stable States: *Strange But True*



Lake Wingra, WI

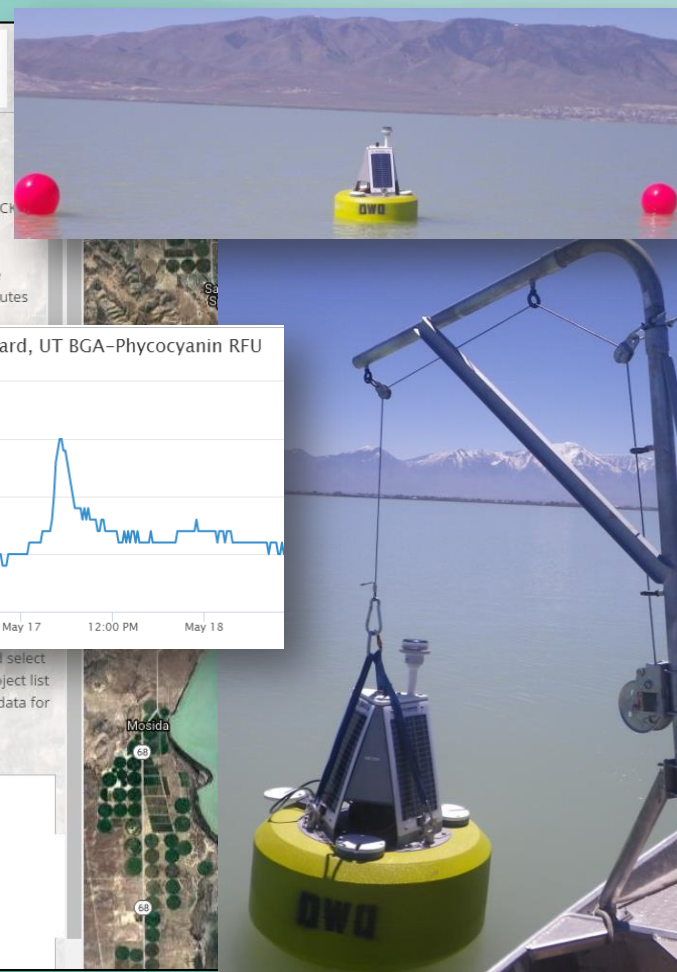
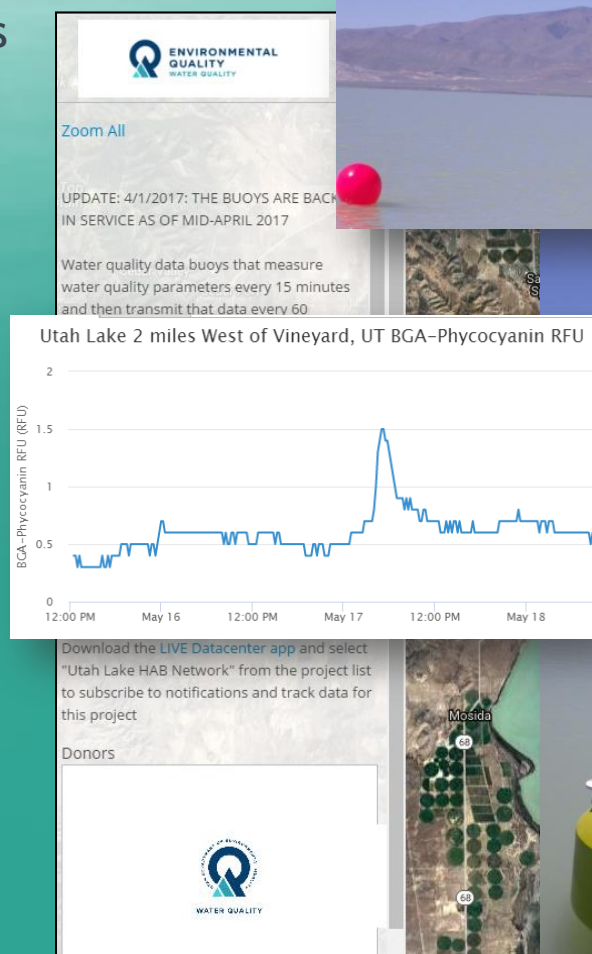
# Utah Lake Basin





# Utah Lake Buoy Network

- 3 high frequency sondes
- Telemetered every 60 min.
- Parameters:
  - Temperature
  - Conductance
  - pH
  - Dissolved oxygen
  - DO saturation
  - Chlorophyll
  - Blue-green algae
  - Turbidity
- iUTAH partnership

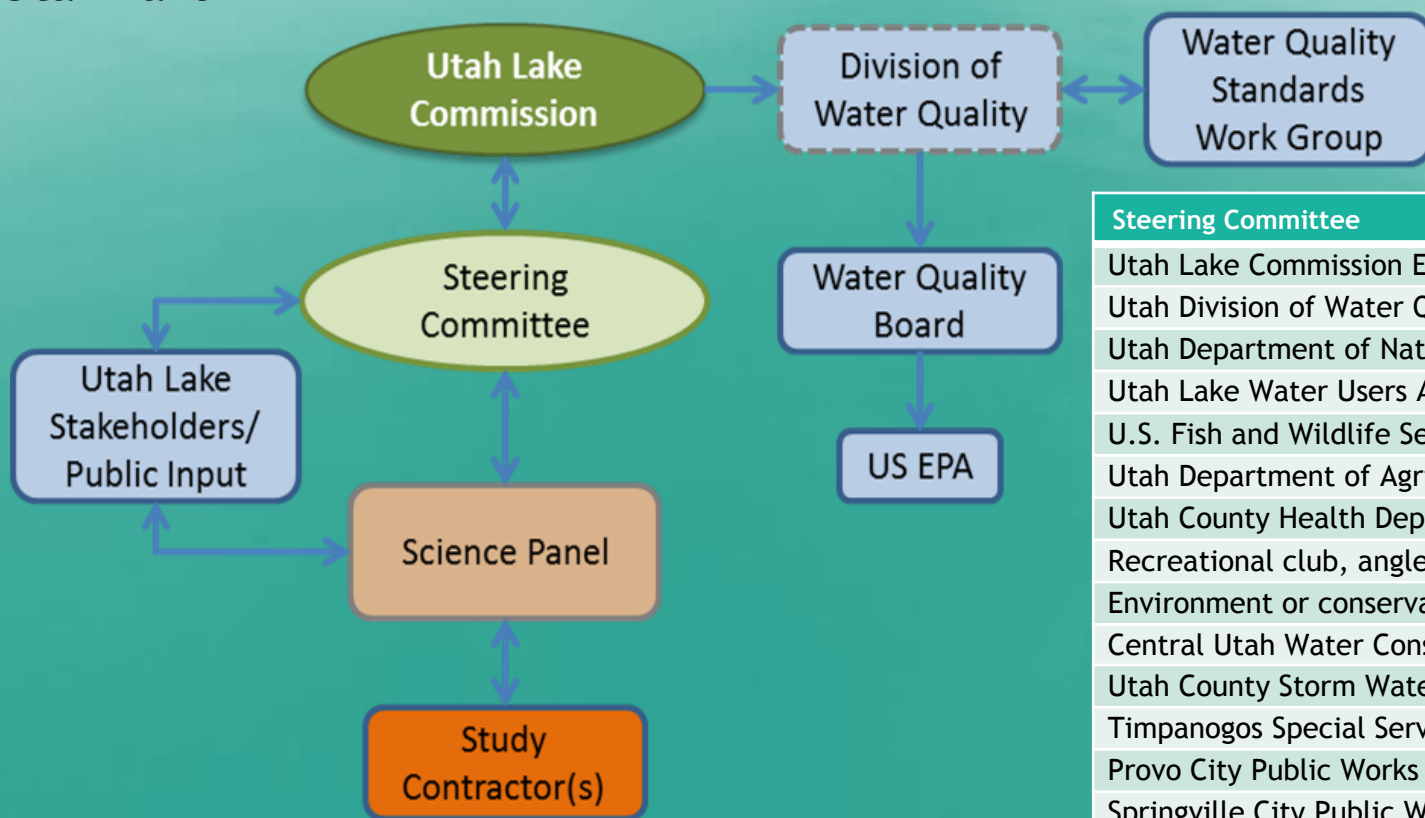


<https://wqdatalive.com/public/669>

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Develop recommendations for any necessary in-lake water quality criteria that are protective of designated uses and sustain natural resources of Utah Lake

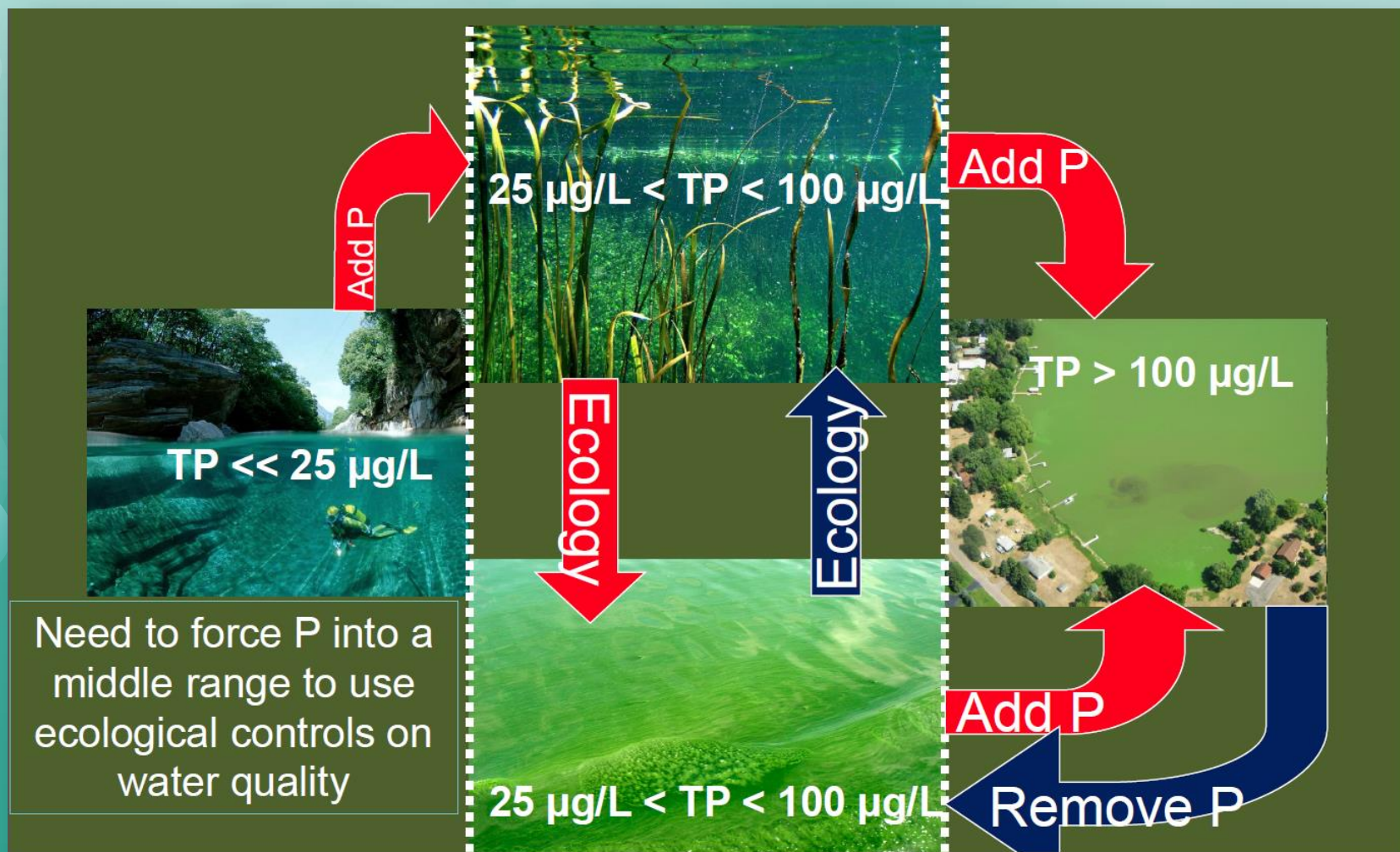


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Springville City Public Works
Alpine City Mayor
BYU researcher



# Alternative Stable States



**Thank  
You!**





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Questions?

